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Josephson junction behavior in top-gated LAO/STO

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It is well known that the two-dimensional electron gas that forms at the LaAlO3/SrTiO3 (LAO/STO) interface undergoes a transition to the superconducting state at temperatures below a few hundred millikelvin. Experiments have demonstrated that magnetic behavior coexists with the observed superconductivity, which could have important implications for the nature of the superconducting state. We have fabricated Josephson junctions in this system using a combination of a global back gate and local, e-beam lithography defined top gates. This method affords us an efficient way for fine spatial control over the properties of the interface, as compared to back gating alone. Modulation of the top gate voltage varies the Josephson coupling in these devices over a wide range. Analysis of the differential resistance of the devices as a function of temperature and gate voltage show that the junctions behave like short, overdamped weak links, and could be an important tool to illuminate the nature of superconductivity in the LAO/STO interface system.